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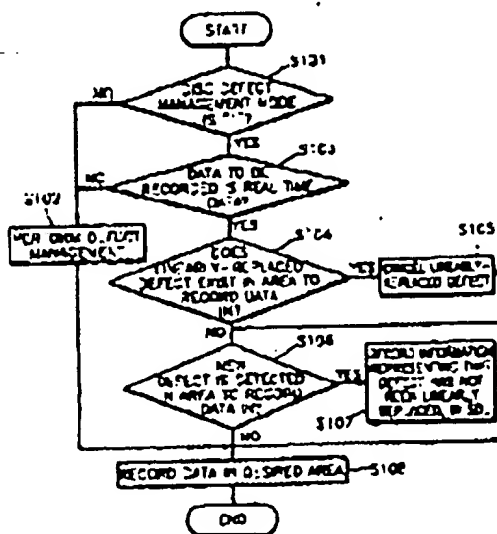
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Recording medium for storing defect management information for recording real time data,  
defect managing method therefore, and real time data recording method

A recording medium for storing defect management information to record real time data, a defect managing method therefor, and a method of recording real time data, are provided. The recording medium stores information representing use or non-use of linear replacement defect management in which a defective area of the recording medium is replaced with the spare

area, in order to record real time data. While maintaining compatibility between the defect managing method and a defect managing method based on a current DVD-RAM standard, i.e., while allowing report of the fact that there are blocks which have not been linearly replaced, linear replacement is not performed when real time data is recorded. Thus, real time data can be recorded and reproduced.

FIG. 9



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The present invention relates to the field of recording medium for storing defect management information with respect to whether linear replacement or a method of effectively managing defects to and/or reproduce video and/or audio data from a versatile disc random access memory (DVD-RAM) in real time, and a method of recording data in a recording medium using defect management information.

Real time recording or reproduction means a given amount of data is necessarily recorded or reproduced within a given time since input information if it is not processed at the moment data is input, is a phenomenon such as a pause of an image or a temporary interruption of music occurs with reproduced data as abnormal information if data is not recorded or reproduced at a predetermined speed. The above-described problems are caused since the input of information cannot be temporally controlled by a recording or reproducing apparatus.

In the DVD-RAM standard version 1.0, a method of managing defects generated on a disk has been used to increase the reliability of data recorded on a disk. Skipping replacement and linear replacement are included as the disclosed defect management methods. The first method processes defects detected in a recording process, and the second method replaces an error correction code (ECC) block unit (16-sector unit) including a sector having a defect generated during use of a disc with a defect-free ECC block in a spare area.

The skipping replacement is used to minimize a reduction in the recording or reproduction speed due to defects, in which a logical sector number is provided to a sector next to a defective sector detected during a certification process for investigating defects of a disc when the disc is initialized, that is, data is recorded or reproduced by skipping a sector on which a defect is generated during recording or reproduction. Here, a real physical sector is pushed back by the sector number designated by skipping the defective sector. Such a left-behind phenomenon is solved by using as many sectors as there are defects in a spare area located at the end portion of a corresponding recording area.

However, the skipping replacement cannot be used for a defect generated while a disc is used. When a defective portion is disregarded and skipped, discontinuity is generated on logical sector numbering, which is that the skipping replacement violates file system. Thus, the linear replacement is used when a defect is generated during use of the disc, which means replacement of an ECC block including a defective sector with an ECC block existing in a spare area.

When the linear replacement is used, no vacancy exists in a logical sector number, however, the position of a sector on a disc is discontinuous, and real

data corresponding to a defective ECC block exists in the spare area.

[0007] As described above, when real time recording, in which the time for temporarily-input information cannot be arbitrarily delayed, such as, recording of broadcast information or a real image, is necessary, information is recorded in an area to be linearly-replaced by undergoing a process in which a real pickup goes up to the spare area and searches for an area to be linearly-replaced, and a process in which the real pickup comes back. Hence, the recording speed is reduced, so that information input in real time cannot be continuously recorded when the linear replacement is used.

[0008] It is prescribed that a DVD-RAM drive according to the DVD-RAM standard version 1.0 processes all of this defect management to reduce the burden of the host computer used in the drive. The host computer is designed to transmit a command ordered not to manage defects to the drive using a command denoted in an interface standard. That is, if the host computer determines whether defect management will be performed, the defect management itself is supposed to be performed by the drive.

[0009] Even when the host computer does not manage defects according to the need of an application program, the DVD-RAM drive according to the DVD-RAM standard version 1.0 must necessarily manage defects recorded in a primary defect list (PDL) and a secondary defect list (SDL) according to a defect management rule. If an area skipping replaced or linear replaced due to defect management performed by another drive exists. Here, it is prescribed that the position of a defective sector replaced according to skipping replacement should be recorded in the PDL, and the position of a defective block replaced according to linear replacement should be recorded in the SDL. That is, when data is recorded after setting the fact that a specific drive should not perform defect management using the linear replacement, it cannot be ensured that other drives must also not perform the linear replacement on the same disc.

[0010] Therefore, when real time recording is performed by a current DVD-RAM drive, it may be difficult because of an area to be used by the linear replacement.

[0011] With a view to solve or reduce the above problems, it is an aim of embodiments of the present invention to provide a recording medium for storing defect management information associated with whether linear replacement is used or not, to record real time data.

[0012] It is another aim to provide a recording medium for storing information for showing a plurality of different defect management modes according to the type of data to be recorded.

[0013] It is still another aim to provide a recording medium for allocating a spare area for only real time recording whose space can be effectively utilized.

[0014] It is yet another aim to provide a method of managing a defect of a recording medium which can

real time data and can have maximum compatibility with a general DVD-RAM disc.

It is still yet another aim to provide a method of recording real time data using the defect management information associated with whether the linear replacement is used.

According to a first aspect of the invention, provided a recording medium including a recording area and a spare area, for storing information representing use or non-use of linear replacement defect management in which a defective area on the recording medium is replaced with the spare area.

Preferably, the information representing use or non-use of linear replacement contains information associated with the entire recording medium.

The information representing use or non-use of linear replacement preferably contains information associated with parts of the recording medium.

The recording medium may be a disc designed by a digital versatile disc (DVD) standard.

The recording medium may be a DVD-RAM signaled by a DVD-RAM standard.

The information representing use or non-use of linear replacement is preferably recorded in a reserved area of a disc certification flag and a group certification flag in a disc definition structure (DDS) provided in the DVD-RAM.

The information representing use or non-use of linear replacement is preferably stored upon initialization.

The information representing use or non-use of linear replacement may be stored just before recording real time data.

Preferably, only the start sector number of a defective block having a defect generated while real time data is recorded on the recording medium is recorded in a sector defect list (SDL). Information representing that a defective block has not been replaced is recorded in the RM bit of an SDL entry for representing replacement or non-replacement of the defective block, and information representing non-replacement is recorded in the start sector number of a replacement block of the entry.

Information representing that linear replacement has been canceled may be further stored in the RM bit of the SDL entry. Information representing that a defective block has been replaced is stored in the RM bit of the SDL entry, and the start sector number of the defective block and that of the replacement block are stored in the SDL entry.

The information representing use or non-use of linear replacement preferably includes information representing that linear replacement is applied with respect to every data on a recording medium, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to every data in the recording medium, and this information is stored in the reserved area of the DDS.

[0025] When real time data is recorded, a spare area for linear replacement is preferably not allocated, and only a spare area for slipping replacement is allocated.

[0027] The spare area for slipping replacement is preferably allocated in the last group of the recording medium by the size of sectors capable of processing a maximum number of entries capable of registering a primary defect list (PDL).

[0028] Preferably, information representing use or non-use of linear replacement, denoting use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for slipping replacement, is stored in a reserved area of the DDS and the PDL.

[0029] According to a second aspect of the invention, there is provided a recording medium for storing defect management mode information for showing a plurality of defect management modes representing use or non-use of linear replacement according to the type of data to be recorded.

[0030] The defect management mode information may be stored in a reserved area of the DDS of a defect management area (DMA).

[0031] The defect management mode information preferably includes first defect management mode information representing that slipping replacement and linear replacement are applied to every data on the recording medium, second defect management mode information representing that linear replacement is selectively applied according to the type of data, and third defect management mode information representing that linear replacement is not applied to every data on the recording medium.

[0032] According to a third aspect of the invention, there is provided a recording medium for storing information representing non-application of linear replacement to all data on the recording medium in a defect management area, in which only a spare area for slipping replacement is allocated.

[0033] The defect management area is preferably a reserved area in the DDS and the PDL, and the spare area for slipping replacement can process a maximum number of entries capable of registering the PDL.

[0034] According to a fourth aspect of the invention, there is provided a defect managing method for a disc recording and/or reproducing apparatus, comprising the steps of:

(a) recording information representing use or non-use of linear replacement defect management with respect to the entire disc or a specific area of a disc; and

(b) determining whether a defective area will be replaced by a block in a spare area using linear replacement according to information representing use or non-use of the linear replacement defect management.

Preferably, in step (a), information representing use or non-use of linear replacement for the entire disc is recorded in a reserved area of a disc certification the DDS provided by the DVD-RAM.

Preferably, in step (a), information representing use or non-use of linear replacement for the specific disc is recorded in a reserved area of a group session flag in the DDS provided by the DVD-RAM.

Preferably, in step (a), the information representing use or non-use of linear replacement is recorded in the initialization of the disc. Alternatively, the information representing use or non-use of linear replacement is recorded just before real time data is recorded in the disc.

1) The information representing use or non-use of linear replacement is preferably information for showing plurality of defect management modes, and this information is recorded in a reserved area of the DDS.

1) Preferably, the information showing the plurality of defect management modes includes information showing that slipping replacement and linear replacement is applied with respect to all data on the recording medium, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to all data on the recording medium.

2) The information representing use or non-use of linear replacement preferably denotes the use of a defect managing method dedicated for real time recording in which linear replacement is not performed by allocating only a spare area for slipping replacement.

1) The spare area for slipping replacement may be located to the last group of a disc, and the information representing use or non-use of linear replacement is recorded in the reserved area of the DDS and the PDL.

2) Preferably, in step (b), when the information representing use or non-use of linear replacement represents the non-use of linear replacement, linear replacement is not used for real time data, but linear replacement is used for data other than real time data.

3) In step (b), when the information representing use or non-use of linear replacement represents the use of linear replacement, linear replacement is preferably not used regardless of whether data is real time data.

4) The defect managing method may further comprise the step of: (c) canceling the linear replacement of a defect on an area where real time data is to be recorded, when the information representing use or non-use of linear replacement represents the non-use of linear replacement.

5) In step (c), the linear replacement may be canceled using a flag representing that the linear replacement has been canceled using a reserved bit in an SDL, information representing that a defective block has been replaced is preferably stored in an FRM bit of the SDL entry, and the start sector number of the defective block and the start sector number of a replacement block may

be stored in the SDL entry.

[0046] In step (c), preferably only the start sector number of a defective block is left in an SDL, information representing that a defective block has not been replaced is stored in an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is stored in the start sector number of a replacement block are stored in the SDL entry.

10 [0047] The defect managing method may further comprise the step of: (d) recording only the start sector number of a block having a defect generated while using a disc on which information that the linear replacement defect management will not be used has been recorded, in an SDL, recording information representing that a defective block has not been replaced in the FRM bit of the SDL entry showing whether the defective block has been replaced, and recording information that the defective block has not been replaced in the start sector number of a replacement block in the SDL entry.

20 [0048] The defect managing method may further comprise the step of: (e) performing defect management based on linear replacement when a defect is generated during use of a disc on which information that the linear replacement defect management will be used has been recorded.

[0049] According to a fifth aspect of the invention, there is provided a method of recording real time data while managing a defect on a disc using a disc recording and/or reproducing apparatus, the method comprising the steps of: (a) determining whether defect management mode information representing whether defect management based on linear replacement will be used; (b) determining whether data to be recorded is real time data, when the defect management mode information is information that the linear replacement will not be used; (c) determining whether a linearly-replaced defect exists in an area to record data in, when the data to be recorded is real time data; and (d) determining whether a new defect is detected in the area to record data in, when no linearly-replaced defect exists in the area to record data in, and recording the real time data in a desired area when the new defect is not detected.

[0050] The method of recording real time data may further comprise the steps of: (e) performing defect management when the defect management mode information is information representing that the linear replacement will be used, in step (a); and (f) performing defect management when data to be recorded is not real time data in step (b).

[0051] The method may further comprise the step of: (g) canceling linear replacement when a linearly-replaced defect exists in an area to record data in, in step (c).

30 [0052] Preferably, in step (g), only the start sector number of a defective block is left in the SDL, information representing that the defective block has not been replaced is stored in an FRM bit of the SDL entry show-

that the defective block has been replaced, and information representing that the defective block has not been replaced is recorded in the start sector number of the defective block in the SDL entry.

Preferably, in step (g), a flag representing that replacement has been canceled is set using a nibble of the SDL entry. Information representing that the defective block has been replaced is stored in one bit of the SDL entry, and the start sector number of the defective block and the start sector number of a spare block are recorded in the SDL entry.

The method may further comprise the step of: recording information representing that linear replacement has not been performed, when a new defective block is detected in step (d).

Preferably, in step (h), only the start sector number of a defective block is left in the SDL. Information representing that the defective block has not been replaced is stored in an FRAM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is recorded in the start sector number of the defective block in the SDL entry.

The defect management mode information is information representing use or non-use of linear replacement for the entire disc, and is stored in a reserved area of a disc certification flag in a DDS provided by DVD-RAM. Alternatively, the defect management mode information may be information representing use or non-use of linear replacement for some data of the disc, and stored in a reserved area of a disc certification flag in a DDS provided by DVD-RAM.

The defect management mode information may include information representing that slipping replacement and linear replacement are applied to data on a disc, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to all data on the disc, and this information is stored in a reserved area of a DDS provided by DVD-RAM.

The defect management mode information may be information representing the use of a defect management method for only real time recording in which slipping replacement is not used by allocating only the spare area for slipping replacement, and is stored in a reserved area of a DDS provided by DVD-RAM and the

For a better understanding of the invention, to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 is a view for explaining a defect management method using slipping replacement of a recording medium;

Figure 2 is a view for explaining a defect management method using linear replacement of a recording medium;

Figure 3 is a table of a defect definition structure (DDS);

Figures 4A and 4B illustrate the structures of the disc certification flag and the group certification flag shown in Figure 3, respectively;

Figure 5 is a table of the contents of a secondary defect list (SDL);

Figure 6 illustrates the structure of the spare area full flag shown in Figure 5;

Figure 7 illustrates the structure of the SDL entry shown in Figure 5;

Figures 8A and 8B illustrate the structures of the disc certification flag and the group certification flag of the DDS for recording real time data proposed by embodiments of the present invention, respectively;

Figure 9 is a flowchart illustrating an embodiment of a method of recording data according to a defect management method of the present invention;

Figure 10 illustrates an example of the structure of an improved SDL entry for canceling linear replacement as proposed by the present invention;

Figure 11 illustrates an example of a DDS for storing information for indicating a plurality of different defect management modes proposed by the present invention;

Figure 12 is a table showing allocated spare areas for recording real time data as proposed by embodiments of the present invention; and

Figure 13 illustrates a DDS and the structure of a primary defect list (PDL) for storing defect management mode information as proposed by embodiments of the present invention for allocating the spare areas for only real time recording shown in Figure 12.

[0080] Preferred embodiments of a recording medium storing defect management information for recording real time data, a defect managing method using the same, and a real time data recording method will now be described with reference to the attached drawings.

[0081] First, slipping replacement and linear replacement will be described in detail referring to Figures 1 and 2 in order to help in the understanding of the present invention.

Figure 1 is a view for explaining a defect management method using the slipping replacement. Physical addresses on a disc shown in Figure 1 are recorded P2, P3, ..., Pn, and logical addresses must be added to record real data in this physically-segmented. These logical addresses act as addresses in a real file system to search for its own data. However, the relationship between the physical addresses and logical addresses is made in a disc initialization process. If a defect is detected on the third physical sector as shown in Figure 1, a logical address is not directed to this defective sector, and a logical sector or L3 is designated to the next physical sector P4. The logical sectors are sequentially pushed back a number of defective sectors, and a spare area at the end of a corresponding data group is used as a pushed portion. In this slipping replacement method, effective processing in sector units is possible simply slipping a defective region, and a pickup does not need to move to a different place upon recording and reproduction by simply disregarding and slipping a defective portion. Thus, the defective region can be avoidable minimizing the delay time. Here, the position of defective sector replaced by the slipping replacement is recorded in the PDL.

3) Figure 2 is a view for explaining a defect management method using linear replacement. In the linear replacement for processing defects generated while a disc is used after being initialized, the defects are managed in an ECC block unit, i.e., in units of 16 sectors. In other words, when an error is generated at a specific sector and a defect is thus detected, if the movement in of at least 16 sectors is not made for error correction, the error correction unit of each data previously recorded in a disc must be changed. Thus, processing in an ECC block unit must be performed, and the slipping replacement method of slipping a defective sector and inserting a logical sector cannot be used since the physical address of an area where data has already been recorded cannot be changed. When a defect is generated in a logical block LB3 as shown in Figure 2, the defective region is recorded in the SDL to be prevented from being used, and the defective portion is replaced by a usable block existing in a spare area. The recorded block (SBk in Figure 2) in the spare area has the same logical block number (LB3) as the erroneous

4) In a reproduction sequence, as shown in Figure 2, reading is continued just before to a defective block as in an area 1, a replaced ECC block existing in a spare area is read by moving a pickup or the like as in area 2, and data is continuously read from a block next to the defective block as in an area 3. In order to process defects as described above, pickup movement is caused such as a process for searching for data, a process for returning to the block right next to the defective block after reading the replaced block. Thus, no time is required to read or write data, so that this

defect management is not appropriate for real time recording.

[0065] Figure 3 is a table of a disc definition structure (DDS) existing in a defect management area (DMA) of a DVD-RAM. In particular, a byte position (BP) 3, a disc certification flag, records the certified contents of the entire disc, and BPs 16 through 39, group certification flags, record the contents of certification of 24 data groups.

[0066] In addition, BPs 0 and 1 are DDS identifiers, and BPs 4 through 7 are the values of counters for updating DOS/PDL representing the total number of times in which a DOS/PDL block is updated and rewritten. That is, when initialization starts, the value of a counter is set to be "0", and increases by one whenever the DOS/PDL is updated or rewritten. All DOS/PDL and SDL blocks must have the same counter value after formatting is completed. BPs 8 and 9 denote the number of groups, and, for example, 24 groups are recorded as "0018" (hexadecimal).

[0067] Figure 4A illustrates the structure of the disc certification flag shown in Figure 3. When a bit b7 among three bits b7, b6 and b5 representing an in-process state is "0b", it indicates format completion, and when the bit b7 is "1b", it indicates an under-formatting state. When the bit b6 is "0b", it indicates the progress of formatting using full certification, and when the bit b6 is "1b", it indicates the progress of formatting using partial certification. When the bit b5 is "0b", it indicates the progress of formatting on the entire disc, and when the bit b5 is "1b", it indicates the progress of formatting on only groups, and indicates that the group certification flag is effective. When a bit b1 representing user certification is "0b", it indicates that a disc has never been certified by a user, and when the bit b1 is "1b", it indicates that a disc has been certified one or more times by a user. When a bit b0 representing disc manufacturer certification is "0b", it indicates that a disc has never been certified by a manufacturer, and when the bit b0 is "1b", it indicates that the disc has been certified one or more times by the manufacturer. Other bits b4, b3, and b2 are reserved. However, "in-process" is set to be "1xx" by any certification before formatting, and when formatting is completed, the "in-process" is reset to be "000".

[0068] Figure 4B illustrates the structure of each of the group certification flags of the bit positions 16 through 39 shown in Figure 3. When a bit b7 among two bits b7 and b6 representing an in-process state is "0b", it indicates format completion of a corresponding group, and when the bit b7 is "1b", it indicates that the corresponding group is being formatted. When the bit b6 is "0b", it indicates that the group is being formatted using full certification, and when the bit b6 is "1b", it indicates that the group is being formatted using partial certification. When a bit b1 representing user certification is "0b", it indicates that the group has never been certified by a user, and when the bit b1 is "1b", it indicates that the group has been certified one or more times by a user.

bits b5, b4, b3, b2, and b0 are reserved.

Figure 5 is a table showing the contents of a defect list (SDL). RBP is the position of a relative byte starting with 0. Relative byte positions 0 and 1 are SDL identifiers, and relative byte positions 2 and 3 are reserved. Relative byte positions 4 through 7 denote total number of updated SDL blocks, and SDL entry counter values increase by one whenever the number of SDL is updated. Relative byte positions 8 through 15 denote spare area full flags, and relative byte positions 16 through 19 denote DOS/PDL updating error values each indicating the total number of times DOS/PDL block is updated and rewritten. The counter value is set to be "0" when initialization starts, and increases by 1 whenever the DOS/PDL is updated or rewritten. As mentioned above, all the DOS/PDL and blocks must have the same count value after formatting is finished. Relative byte positions 20 and 21 are reserved, and relative byte positions 22 and 23 indicate the number of entries in the SDL. The remaining relative byte positions indicate each SDL entry.

[6] Figure 6 illustrates the structure of the spare area full flag of the relative byte positions 8 through 15 in Figure 5. In Figure 6, if a bit representing a corresponding group is "1", it indicates that no spares are left in the corresponding group, and if the bit is "0", it indicates that a spare block remains in the corresponding group.

[7] Figure 7 illustrates the structure of the SDL entry shown in Figure 5. In Figure 7, FRM is a bit representing whether a defective block has been replaced. In the defective block has been replaced, FRM records a binary "0", and when the defective block has been replaced or no spare areas exist, FRM records a binary "1". The SDL entry includes the sector number of the first sector of a defective block, and the sector number of the first sector of a replacement block. Here, if a defective block has not been replaced, a hexadecimal "000000" is recorded in an area where the first sector number of the replacement block is recorded.

[8] Meanwhile, in real time recording, whether recording data can be processed within a given time becomes more important than some errors of real data. In particular, in the case of an image or the like, an error generated to part of a screen when a small error exists in the image. On the other hand, when input data cannot be processed in time, continuous data error is generated making normal reproduction impossible. Therefore, the timing of data in time is more important.

[9] Thus, as for the real time recording, a method requiring non-use of the linear replacement must be suggested. When the linear replacement is not used, there must be a portion recording the fact that a corresponding block is in use without using the linear replacement. A method of recording such a content will be described referring to Figures 8A and 8B.

[10] Figures 8A and 8B illustrate the structures of the disc certification flag and the group certification flag

of the DOS proposed by the present invention to record real time data, respectively. The structures of the disc certification flag and the group certification flag of Figures 8A and 8B are the same as those of Figures 4A and 4B except for a bit position b2. That is, as shown in Figure 8A, when the entire corresponding disc is used without the linear replacement, the bit position b2 of the disc certification flag is set as "1", and when the corresponding disc is used by the linear replacement as in the prior art, the bit position b2 is set as "0". In Figures 8A and 8B, information associated with use or non-use of the linear replacement stored in the bit position 2(b2) is called a disc defect management mode.

[11] Also, when only specific groups are partially utilized to prevent the linear replacement, as shown in Figure 8B, the bit position 2(b2) of the group certification flag for a corresponding group is set as "1" to indicate that linear replacement is not performed on a data region in the corresponding group. In an embodiment of the present invention, the bit positions 2(b2) of the disc certification flag and the group certification flag are used as shown in Figures 8A and 8B, but another reserved bit can be used. Here, each existing b2 region is reserved, and its value is recorded as "0".

[12] When the bit b2 for a disc defect management mode of the disc certification flag or group certification flag is set as "1" upon initialization of a disc, the SDL records only the start sector address of a block having a defect generated during use of the disc, records an FRM bit of the SDL entry as "1", and the linear replacement is not performed. A hexadecimal "000000" is recorded in an area for recording the first sector number of a replacement block of the SDL entry.

[13] In this way, while compatibility between a defect managing method based on a current DVD-RAM standard and a method of the present invention is maintained, i.e., while a method capable of indicating the existence of nonlinearly-replaced blocks as in an existing defect managing method is suggested, a method allowing a defective block not to be linearly replaced is also provided to thereby accomplish recording and reproduction of real time data.

[14] A determination of whether a defective region will be replaced by a block existing in a spare area using linear replacement is made by information associated with use or non-use of linear replacement defect management recorded in a defect management region on the entire disc or a specific area of the disc regardless of the type of data to be recorded in a corresponding area.

[15] Also, a determination of whether a defective region will be replaced by a block existing in a spare area using the linear replacement is made by information associated with use or non-use of linear replacement defect management recorded in a defect management region on the entire disc or in a specific area on the disc in the case of only data required to be recorded in real time.

1) A method of preventing linear replacement respect to the entire disc or a specific group of discs described on the basis of the above-described embodiment. In another embodiment, when a disc defect management mode is set as "1", it can be used as information that the linear replacement is not performed respect to a block having a defect in an area of a recording information requiring real time recording reproduction, but the linear replacement can be performed with respect to an area of a disc not requiring time recording. In this case, when data not requiring time recording has already been recorded in an area which real time data must be recorded, and a defective region is thus linearly replaced, the linear replacement of the defective region must be capable of being canceled. Therefore, when the disc defect management mode is set as "1", this can mean that the linear replacement of the defect can be canceled when real information is recorded.

(1) In order to prevent entire linear replacement respect to the entire disc or a given group on the information associated with the disc defect management mode is set as "1" upon initialization. On the other hand, when linear replacement is not performed in the case of recording real time data, there is no need to set the defect management mode information at initialization. That is, when it is determined that there is a necessity for recording real time data in a disc, disc defect management mode is set as "1" just before the real time data is recorded. At this time, a determination of whether a corresponding disc is suitable for recording real time data is made on the basis of the sum or distribution of a defect generated on the disc, and it is determined that the disc is suitable, the disc defect management mode is set as "1". Otherwise, a case for informing a user that the disc is not suitable for recording real time data is required.

82] Figure 9 is a flowchart illustrating a method of recording data in real time without performing defect management using linear replacement with respect to data desired to be recorded when the disc defect management mode is "1".

83] In Figure 9, first, a determination of whether a disc defect management mode is "1" is set before recording of data on a disc begins. In step S101, if the disc defect management mode is "1", it is determined whether data to be recorded is real time data. In step S103, if the defect management mode is "0", every data is recorded on the basis of a general defect managing method defined in the standard book version 1.0. In steps S102 and S108, when it is determined in step S103 that data to be recorded is not real time data, step S102 of forming general defect management is performed. When it is determined in step S103 that data to be recorded is real time data, it is determined whether an already-linearly-replaced defect exists in an area where data is to be recorded, in step S104.

84] When it is determined in step S104 that the lin-

early-replaced defect exists in the area to record data in, the linearly-replaced defect is canceled, in step S105. When no linearly-replaced defect exists in the area to record data in, it is determined whether a newly-detected defect exists in the area to record data in, in step S106.

[0085] When it is determined in step S106 that a new defect is detected, information representing that a defect has not been linearly replaced is recorded in a secondary defect list (SDL) of a defect management area, in step S107. Next, data is recorded in a desired area in step S108. Also, when a new defect is not detected in step S106, step S108 of recording real time data in a desired region is performed.

15 [0086] Step S105 of canceling a linearly-replaced defect, and step S107 of recording information representing that a defect has not been linearly replaced are performed by recording the first sector number of a replacement block as a hexadecimal "000000", among linearly-replaced defect information recorded in the SDL, and by recording the FRM information as "1". In this case, since the disc defect management mode is set as "1", it can be recognized from the comparison of this mode information with FRM information that the meaning of the FRM information becomes different from that of existing FRM information.

[0087] That is, the FRM information based on the existing standard book denotes that a block having a defect generated for a certain reason has not been replaced with a block in a spare area or no spare area can be replaced. On the other hand, FRM information based on a new definition is added to the meaning of the existing FRM and can be information representing that when the disc defect management mode is "1", the linear replacement of a defective block replaced by an existing linear replacement method has been canceled for real time recording, or the defective block has not been linearly replaced for real time recording.

[0088] Since a disc whose defect management mode is set as "1" is likely to include real time information, the disc can be utilized as information of prohibiting reallocation of information on a disc without consideration of real time information. Piece collection of collecting the pieces of a file on a disc, and read after reallocation can be included as a method of reallocating the information on a disc. The read after allocation is a method of reading data and then replacing a data block likely to have a defect with a block located in a spare area.

[0089] Figure 10 illustrates the structure of an improved SDL entry for canceling linear replacement proposed by the present invention. When an already-replaced defect exists on a corresponding disc upon recording of real time data, a method of recording the information of an area, in which the first sector number of the replacement block as described above is recorded, as a hexadecimal "000000" and setting an FRM bit as "1" is exemplified as a process for canceling the linear replacement.



91] This method can minimize the change in the recording standard. However, in this method, the information of a block which is determined as defective and read must be deleted, so that linear replacement may be primarily performed, canceled, and again performed successively using a spare area. In particular, if a linearly-replaced block in the spare area is deleted and again replaced, information associated with linearly-replaced defective block in the spare area is lost.

92] Thus, it would be preferable that blocks in a corresponding spare area are successively used when linear replacement occurs, and that even when the linear replacement is canceled, information associated with a block in the spare area replacing a corresponding defective block is maintained. When only a region record on an FPM bit and the first sector number of a replacement block is used to maintain information associated with the replaced sector number of the spare area, it is possible to tell if the corresponding replaced block has again been replaced on account of a defect or if the linear replacement has been canceled to record real time data.

93] In order to solve such a problem, a canceled or replacement (CLR) flag is newly defined by using spare bit of the SDL entry which is not in use. When linear replacement with respect to a corresponding SDL entry is canceled for recording real time data, a method setting the CLR flag as "1" can be used. Here, when the CLR flag is set as "0", it indicates a replacement block allocated without being used by real time data. In structure of an SDL entry of Figure 10, for example, bit b31 not in use is used as the CLR flag.

94] Meanwhile, defect management information recording real time data can be roughly divided into three cases in which: (1) real time data is not recorded in the entire disc; (2) two types of data, i.e., real time data and non-real time data, coexist on a disc, and a linear replacement defect managing method is not used with respect to only the real time data; and (3) only the real time data is recorded in the entire disc, i.e., the linear replacement defect managing method is not used with respect to all recorded data.

95] Particularly, in the third case, real time replacement is not used for the entire disc, so that a spare area defect management can be set to a smaller size than the first and second cases. This will be described in detail later referring to Figures 12 and 13.

96] When these three or more defect managing methods are applied to one disc, various correspondences are possible according to the purpose of use of the disc, and the disc can be more effectively used. However, considering a condition such as the case of changing and using discs between reproduction apparatuses, defect management conditions in which a corresponding disc is used must be described in more detail. The disc defect management mode information representing use or non-use of linear replacement described

in Figure 8 is deficient for defect management information in the above case.

97] Thus, as shown in Figure 11, defect management mode information capable of representing linear replacement or non-linear replacement depending on a plurality of different defect management modes is stored in a reserved byte located in the DOS of the defect management area (DMA) on a disc. That is, Figure 11 shows the case of using two significant bits b7 and b6 of the relative byte position BP10 of DOS, i.e., the eleventh byte thereof, by taking defect management (DM) mode depending on use or non-use of linear replacement as an example.

98] As shown in Figure 11, when the DM mode information is "00b", it indicates that the slipping replacement and the linear replacement are applied to all data on a disc, when the DM mode information is "01b", it indicates that the linear replacement is selectively applied according to the type of information (here, real time data and non-real time data), and when the DM mode information is "10b", it indicates that the linear replacement is not used with respect to every data.

99] That is, when the DM mode information is "00b", the slipping replacement and the linear replacement are mandatory, and this mode is only for data other than real time data in the first case described above. When the DM mode information is "01b", the linear replacement is mandatory, but the linear replacement for real time data is optional. This mode is defect management for a hybrid disc including both real time data and non-real time data in the second case described above. When the DM mode information is "10b", only the slipping replacement is allowable, and this mode is defect management for only real data in the third case described above. When the DM mode information is "10b", the physical layout of a disc can be changed.

100] Meanwhile, since linear replacement cannot be used to record real time data, a spare area necessary for linear replacement does not actually become necessary. For this case, in the present invention, only a spare area for slipping replacement is set in the last group without allocating a spare area for linear replacement as shown in Figure 12. In particular, the spare area set in the last group (here, a thirty fourth group) allocates 7680 sectors (480 ECC blocks) to a spare area for slipping replacement to process a maximum of 7679 entries capable of being registered in a primary defect list (PDL). In Figure 12, sect denotes a sector, blk denotes block, and rev denotes revolutions.

101] In order to obtain the compatibility between the present invention and an existing defect management structure, a flag, capable of discriminating a case in which spare areas for only slipping replacement are allocated only for real time recording from a case in which spare areas for linear replacement and slipping replacement are allocated according to an existing defect management method, is represented with significant bits b7 and b6 of the relative byte position BP 10 in the DOS

the PDL, as shown in Figure 13.

01] As shown in Figure 13, when two significant bits b7 and b8 representing a DM mode on the byte position BP 10 of the DDS/PDL are "00b", it indicates that existing defect managing method is applied, and in the two significant bits b7 and b8 are "10b", a defect managing method for only real time recording with linear replacement, in which only the spare area for ping replacement is allocated in the last group of a disc, is applied. Thus, spare areas are allocated by a method dedicated for real time recording, thereby increasing the efficiency due to the application of the use of a disc.

02] As described above, while compatibility between a method of the present invention and a defect managing method based on the current DVD-RAM standard is maintained, linear replacement is not performed when real time data is recorded. Thus, real time data can be recorded and reproduced.

03] In embodiments of the present invention, information representing a plurality of different defect management modes depending on the type of data to be recorded is stored, so that various correspondences are possible according to the purpose of use of the recording medium. Thus, the recording medium can be more actively used.

04] Also, in embodiments of the present invention, when real time data is recorded, spare areas are allowed to be used for only real time. Thus, the effectiveness due to the application of the space of a disc can be increased.

05] The reader's attention is directed to all papers and documents which are filed concurrently with or prior to this specification in connection with this application and which are open to public inspection with this application, and the contents of all such papers and documents are incorporated herein by reference.

06] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

07] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

08] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

# Claims

1. A recording medium including a recording area and a spare area, for storing information representing use or non-use of linear replacement defect management in which a defective area on the recording medium is replaced with the spare area.
2. The recording medium as claimed in claim 1, wherein the information representing use or non-use of linear replacement contains information associated with the entire recording medium.
3. The recording medium as claimed in claim 1, wherein the information representing use or non-use of linear replacement contains information associated with parts of the recording medium.
4. The recording medium as claimed in claim 1, 2 or 3, wherein the recording medium is a disc designated by a digital versatile disc (DVD) standard.
5. The recording medium as claimed in claim 1, 2 or 3, wherein the recording medium is a DVD-RAM disc designated by a DVD-RAM standard.
6. The recording medium as claimed in claim 1, 2, 3, 4 or 5, wherein the information representing use or non-use of linear replacement is recorded in a reserved area of a disc certification flag and a group certification flag in a disc definition structure (DDS) provided by the DVD-RAM.
7. The recording medium as claimed in any of claims 1 to 6, wherein the information representing use or non-use of linear replacement is stored upon initialization.
8. The recording medium as claimed in any of claims 1 to 6, wherein the information representing use or non-use of linear replacement is stored just before recording the real time data.
9. The recording medium as claimed in any of the preceding claims, wherein only the start sector number of a block having a defect generated while real time data is recorded on the recording medium is recorded in a secondary defect list (SDL). Information representing that the defective block has not been replaced is recorded in an FPM bit of an SDL entry for representing replacement or non-replacement of the defective block, and information representing non-replacement is recorded in the start sector number of a replacement block of the SDL entry.
10. The recording medium as claimed in claim 9, wherein information representing that linear replacement has been canceled is further stored in a reserved

bit of the SDL entry, information representing that the defective block has been replaced is stored in the FRM bit of the SDL entry, and the start sector number of the defective block and that of the replacement block are stored in the SDL entry.

The recording medium as claimed in any of the preceding claims, wherein the information representing use or non-use of linear replacement includes information representing that linear replacement is applied with respect to every data on a recording medium, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to every data on the recording medium, and this information is stored in the reserved area of the DDS.

The recording medium as claimed in any of the preceding claims, wherein when real time data is recorded, a spare area for linear replacement is not allocated, and only a spare area for slipping replacement is allocated.

The recording medium as claimed in claim 12, wherein the spare area for slipping replacement is allocated in the last group of the recording medium by the size of sectors capable of processing a maximum number of entries capable of registering a primary defect list (PDL).

The recording medium as claimed in claim 13, wherein information representing use or non-use of linear replacement, denoting use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for slipping replacement, is stored in a reserved area of the DDS and the PDL.

A recording medium for storing defect management mode information for showing a plurality of defect management modes representing use or non-use of linear replacement according to the type of data to be recorded.

1. The recording medium as claimed in claim 16, wherein the defect management mode information is stored in a reserved area of the DDS of a defect management area (DMA).

2. The recording medium as claimed in claim 15 or 16, wherein the defect management mode information includes first defect management mode information representing that slipping replacement and linear replacement are applied to every data on the recording medium, second defect management mode information representing that linear replacement is selectively applied according to the type of data,

and third defect management mode information representing that linear replacement is not applied to every data on the recording medium.

5 18. A recording medium for storing information representing non-application of linear replacement to all data on the recording medium in a defect management area, in which only a spare area for slipping replacement is allocated.

10 19. The recording medium as claimed in claim 18, wherein the defect management area is a reserved area in the DDS and the PDL, and the spare area for slipping replacement can process a maximum number of entries capable of registering the PDL.

15 20. A defect managing method for a disc recording and/or reproducing apparatus, comprising the steps of:

20 (a) recording information representing use or non-use of linear replacement defect management with respect to the entire disc or a specific area of a disc; and

25 (b) determining whether a defective area will be replaced by a block in a spare area using linear replacement according to information representing use or non-use of the linear replacement defect management.

30 21. The defect managing method as claimed in claim 20, wherein in step (a), information representing use or non-use of linear replacement for the entire disc is recorded in a reserved area of a disc certification flag in the DDS provided by the DVD-RAM.

35 22. The defect managing method as claimed in claim 20 or 21, wherein in step (a), information representing use or non-use of linear replacement for the specific area of the disc is recorded in a reserved area of a group certification flag in the DDS provided by the DVD-RAM.

40 23. The defect managing method as claimed in claim 20, 21 or 22, wherein in step (a), the information representing use or non-use of linear replacement is recorded upon initialization of the disc.

45 24. The defect managing method as claimed in any of claims 20 to 23 wherein in step (a), the information representing use or non-use of linear replacement is recorded just before real time data is recorded on the disc.

50 25. The defect managing method as claimed in any of claims 20 to 24, wherein the information representing use or non-use of linear replacement is information for showing a plurality of defect management

modes, and this information is recorded in a reserved area of the DDS.

25. The defect managing method as claimed in claim 25, wherein the information showing the plurality of defect management modes includes information representing that slipping replacement and linear replacement is applied with respect to all data on the recording medium, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to all data on the recording medium.

27. The defect managing method as claimed in any of claims 20 to 26, wherein the information representing use or non-use of linear replacement denotes the use of a defect managing method dedicated for real time recording in which linear replacement is not performed by allocating only a spare area for slipping replacement.

28. The defect managing method as claimed in claim 27, wherein the spare area for slipping replacement is allocated to the last group of a disc, and the information representing use or non-use of linear replacement is recorded in the reserved area of the DDS and the PDL.

29. The defect managing method as claimed in any of claims 20 to 28, wherein in step (b), when the information representing use or non-use of linear replacement represents the non-use of linear replacement, linear replacement is not used for real time data, but linear replacement is used for data other than real time data.

30. The defect managing method as claimed in any of claims 20 to 28, wherein in step (b), when the information representing use or non-use of linear replacement represents the non-use of linear replacement, linear replacement is not used regardless of whether data is real time data.

31. The defect managing method as claimed in any of claims 20 to 30, further comprising the step of:

(c) cancelling the linear replacement of a defect on an area where real time data is to be recorded, when the information representing use or non-use of linear replacement represents the non-use of linear replacement.

32. The defect managing method as claimed in claim 31, wherein in step (c), the linear replacement is canceled using a flag representing that the linear replacement has been canceled using a reserved bit in an SDL, information representing that a defec-

tive block has been replaced is stored in an FRM bit of the SDL entry, and the start sector number of the defective block and the start sector number of a replacement block are stored in the SDL entry.

33. The defect managing method as claimed in claim 31, wherein in step (c), only the start sector number of a defective block is left in an SDL, information representing that a defective block has not been replaced is stored in an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is stored in the start sector number of a replacement block are stored in the SDL entry.

34. The defect managing method as claimed in any of claims 20 to 33, further comprising the step of:

(d) recording only the start sector number of a block having a defect generated while using a disc on which information that the linear replacement defect management will not be used has been recorded, in an SDL, recording information representing that a defective block has not been replaced in the FRM bit of the SDL entry showing whether the defective block has been replaced, and recording information that the defective block has not been replaced in the start sector number of a replacement block in the SDL entry.

35. The defect managing method as claimed in any of claims 20 to 34, further comprising the step of:

(e) performing defect management based on linear replacement when a defect is generated during use of a disc on which information that the linear replacement defect management will be used has been recorded.

36. A method of recording real time data while managing a defect on a disc using a disc recording and/or reproducing apparatus, the method comprising the steps of:

(a) determining whether defect management mode information representing whether defect management based on linear replacement will be used;

(b) determining whether data to be recorded is real time data, when the defect management mode information is information that the linear replacement will not be used;

(c) determining whether a linearly-replaced defect exists in an area to record data in, when

- the data to be recorded is real time data; and
- (d) determining whether a new defect is detected in the area to record data in, when no linearly-replaced defect exists in the area to record data in, and recording the real time data in a desired area when the new defect is not detected.
37. The method of recording real time data as claimed in claim 36, further comprising the steps of:
- (e) performing defect management when the defect management mode information is information representing that the linear replacement will be used, in step (e); and
- (f) performing defect management when data to be recorded is not real time data in step (b).
38. The method of recording real time data as claimed in claim 36 or 37, further comprising the step of:
- (g) canceling linear replacement when a linearly-replaced defect exists in an area to record data in, in step (c).
39. The method as claimed in claim 38, wherein in step (g), only the start sector number of a defective block is left in the SDL, information representing that the defective block has not been replaced is stored in an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is recorded in the start sector number of a replacement block in the SDL entry.
40. The method as claimed in claim 38, wherein in step (g), a flag representing that linear replacement has been canceled is set using a reserved bit of the SDL entry, information representing that a defective block has been replaced is stored in an FRM bit of the SDL entry, and the start sector number of the defective block and the start sector number of a replacement block are recorded in the SDL entry.
41. The method of recording real time data as claimed in any of claims 36 to 40, further comprising the step of:
- (h) recording information representing that linear replacement has not been performed, when a new defect is detected in step (d).
42. The method as claimed in claim 41, wherein in step (h), only the start sector number of a defective block is left in the SDL, information representing that the defective block has not been replaced is stored in

an FRM bit of the SDL entry showing whether the defective block has been replaced, and information representing that the defective block has not been replaced is recorded in the start sector number of a replacement block in the SDL entry.

43. The method as claimed in any of claims 36 to 42, wherein the defect management mode information is information representing use or non-use of linear replacement for the entire disc, and is stored in a reserved area of a disc certification flag in a DDS provided by DVD-RAM.
44. The method as claimed in any of claims 36 to 42, wherein the defect management mode information is information representing use or non-use of linear replacement for some data groups of the disc, and is stored in a reserved area of a group certification flag in a DDS provided by DVD-RAM.
45. The method as claimed in any of claims 36 to 44, wherein the defect management mode information includes information representing that clipping replacement and linear replacement are applied to all data on a disc, information representing that linear replacement is selectively applied according to the type of data, and information representing that linear replacement is not applied to all data on the disc, and this information is stored in a reserved area of a DDS provided by DVD-RAM.
46. The method as claimed in any of claims 36 to 45, wherein the defect management mode information is information representing the use of a defect managing method for only real time recording in which linear replacement is not used by allocating only the spare area for clipping replacement, and is stored in a reserved area of a DDS provided by DVD-RAM and the PDL.

FIG. 1

P1 L1	P2 L2	P3 xx	P4 L3	P5 L4	...	Pn Lm	S1 Lm+1	...	Sk Lm+k	...
USER DATA AREA							SPARE SECTOR AREA			
DATA GROUP										

FIG. 2

LB1	LB2	<del>LB3</del>	LB4	LB5	...	LBn	SD1	...	SBk LB3	...
USER DATA AREA							SPARE SECTOR AREA			
DATA GROUP										
1							2			
3										

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FIG. 3

BP	Contents	Number of bytes
0 to 1	DDS Identifier(DAOAh)	2bytes
2	Reserved	1bytes
3	Disc certification Flag	1bytes
4 to 7	DDS/PDL, update counter	4bytes
8 to 9	Number of Groups	2bytes
10 to 15	Reserved	6bytes
16	Group certification for Group0	
17	Group certification for Group1	
...	...	
39	Group certification for Group23	
40 to 79	Reserved	64bytes
80 to 2047	Reserved	1968bytes

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FIG. 4A

b7	b6	b5	b4	b3	b2	b1	b0
In-Process		Reserved		User Certification		Disc Manufacturer Certification	

FIG. 4B

b7	b6	b5	b4	b3	b2	b1	b0
In-Process		Reserved		User Certification		Reserved	



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FIG. 5

BP	Contents	Number of bytes
0 to 1	SDL Identifier(0002h)	2bytes
2 to 3	Reserved	2bytes
4 to 7	SDL update counter	4bytes
8 to 15	Spore area full flag	8bytes
16 to 19	ODS/PDL, update counter	4bytes
20 to 21	Reserved	2bytes
22 to 23	number of SDL entries	2bytes
24 to 31	first SDL entry	8bytes
...	...	...
m to m+7	last SDL entry	8bytes

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FIG. 6

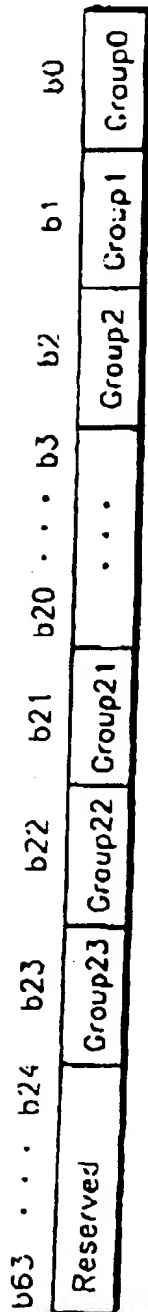
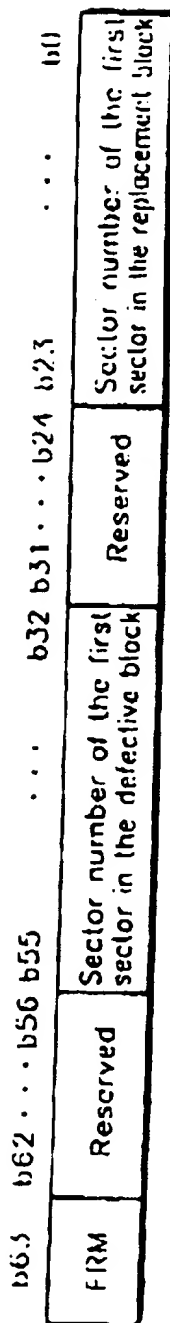


FIG. 7



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FIG. 8A

b7	b6	b5	b4	b3	b2	b1	b0
In-Process	Reserved		Disc Defect Management Mode	User Certification	Disc Defect Manufacturer Certification		

FIG. 8B

b7	b6	b5	b4	b3	b2	b1	b0
In-Process	Reserved		Disc Defect Management Mode	User Certification	Reserved		

FIG. 9





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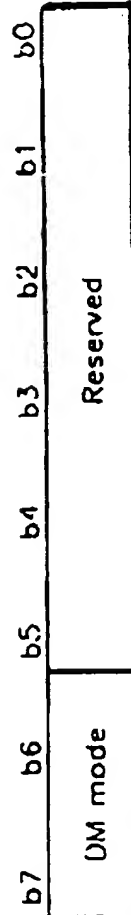
FIG. 12

Line	Start Station Milepost P.O.	Grand Area	G.P. No.	Unit Area	Sector number		Quantity	End Station Milepost
					Sector number	of sq		
0	15	31000	0	31000 - 31000	1100	0	31000 - 31000	3991F
1	26	39900	4	39900 - 40000	1100	0	40000 - 40000	4000F
2	27	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
3	28	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
4	28	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
5	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
6	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
7	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
8	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
9	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
10	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
11	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
12	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
13	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
14	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
15	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
16	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
17	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
18	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
19	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
20	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
21	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
22	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
23	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
24	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
25	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
26	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
27	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
28	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
29	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
30	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
31	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
32	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
33	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
34	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
35	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
36	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
37	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
38	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
39	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F
40	31	40000	4	40000 - 40000	1100	0	40000 - 40000	4000F

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FIG. 13

BP 10 in DDS/POL



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